

C. Claims

Please cancel claim 11 without prejudice or disclaimer, amend claims 1-10 and 12-32 and add new claim 33 as follows. A complete listing of all the claims appears below; this listing replaces all earlier amendments and listings of the claims.

1. (Currently Amended) A method, in printing an image comprising a plurality of image values, of compensating for one or more defective printer nozzles in a plurality of printer nozzles, said method comprising the steps of:

 biasing, for each first image value associated with a first nozzle, at least one second image value associated with another nozzle, said biasing being dependent upon said first image value and a ~~term~~ printing desirability factor for said first nozzle; ~~and~~

~~printing the image in accordance with the biased image values, said biasing~~
 halftoning said at least one biased second image value to form at least one corresponding nozzle firing value; and

printing the image using said at least one nozzle firing value to thereby emulate the intended output of the first nozzle, thereby reducing print artefacts otherwise caused by the one or more defective nozzles.

2. (Currently Amended) ~~A~~ The method according to claim 1, ~~whereby the term wherein the printing desirability factor~~ for said first nozzle provides a measure of one of effectiveness and defectiveness of said first nozzle.

3. (Currently Amended) ~~A~~ The method according to claim 1, ~~whereby~~
wherein said biasing comprises the sub-step of:

redistributing one of part of said first image value and all of said first image
value to said at least one ~~or more~~ second image values value associated with the other
nozzle being an immediately ~~neighbouring nozzles~~ neighboring nozzle of a ~~the~~ same colour
color.

4. (Currently Amended) ~~A~~ The method according to claim 3, ~~whereby~~
wherein an extent of image value redistribution is dependent upon an allowed operating
range of the at least one ~~or more~~ second image values value associated with said
immediately ~~neighbouring~~ neighboring nozzles.

5. (Currently Amended) ~~A~~ The method according to claim 4, ~~whereby~~
wherein said allowed operating range of said at least one second image values value is
between 0% and 100%, wherein 100% represents a maximum intensity for unbiased image
values.

6. (Currently Amended) ~~A~~ The method according to claim 4, ~~whereby~~
wherein said allowed operating range of said at least one second image values value is
between 0% and 200%, wherein 100% represents a maximum intensity for unbiased image
values, and 200% represents a super-intensity for biased image values.

7. (Currently Amended) ~~A~~ The method according to claim 1, ~~whereby~~
wherein said biasing further comprises the ~~sub-steps~~ sub-step of:

increasing an image value associated with a corresponding nozzle of another
~~colour~~ color.

8. (Currently Amended) ~~A~~ The method according to claim ~~1~~, ~~whereby~~ 3,
wherein said biasing further comprises the ~~sub-steps~~ sub-step of:

~~redistributing one of part of said first image value and all of said first image~~
~~value associated with said first nozzle to one or more image values associated with~~
~~immediately neighbouring nozzles of a same colour; and~~

increasing an image value associated with a corresponding nozzle of another
~~colour~~; color, said increase being dependent upon a residual image value of said first
nozzle after said ~~redistribution~~ redistributing step.

9. (Currently Amended) ~~A~~ The method according to claim 6 further
comprising, prior to printing the image, the sub-step of:

mapping the biased image values from a biased image value range of 0%
to 200%, to a range of 0% to 100%.

10. (Currently Amended) ~~A~~ The method according to claim 9, ~~whereby~~
wherein said mapping uses checkerboard ~~quantisation~~ quantization, said method
comprising the steps of:

dividing said biased image values by 2; and
alternately rounding successive divided image values up, and down.

11. (Cancelled)

12. (Currently Amended) ~~A~~ The method according to claim 11, whereby 6,
wherein, in a multi-level halftoning process, a relationship between an ~~input~~ image value
and a corresponding average ~~halftone output~~ nozzle firing value is adjusted in order to tune
a ~~utilisation~~ utilization of super-intensity printing.

13. (Currently Amended) A method of printing an image comprising a
multi-level halftoned image plurality of image values using a print head having a plurality
of print nozzles wherein at least one print nozzle is defective, the method comprising the
steps of:

adjusting tuning an error diffusion table to establish a relationship between
~~input~~ the image values and corresponding average ~~halftone output~~ nozzle firing values
~~using an error diffusion table dependent upon printing desirability factors of the print~~
nozzles in the print head; and

printing the multi-level halftoned image using the error diffusion table using
the steps of:

biasing, for each first said image value associated with said defective
nozzle, at least one second said image value associated with another said nozzle, said

biasing being dependent upon said first image value and a printing desirability factor for said defective nozzle;

halftoning, using the tuned error diffusion table, said at least one biased second image value to form at least one corresponding nozzle firing value; and

printing the image using said at least one nozzle firing value to thereby emulate the intended output of the first nozzle, thereby reducing print artefacts otherwise caused by the one or more defective nozzles.

14. (Currently Amended) An image recording apparatus for recording an image comprising a plurality of image values, the apparatus comprising:

(a) a plurality of forming elements for forming an the image according to input using image forming recording signals;

(b) memory means for storing data for said forming elements indicating the relative desirability of ~~utilising~~ utilizing said forming elements for forming an the image;

(c) image processing means for computing biased image recording signals values using said ~~input image forming signals values~~ and said data stored in said memory means, wherein where the use of a particular forming element is biased ~~using~~ dependent upon the relative desirability data of other forming elements; and

halftoning means for halftoning the biased image values to form corresponding said image recording signals.

15. (Currently Amended) An image recording apparatus for recording an

image comprising a plurality of image values, the apparatus comprising:

(a) a plurality of forming elements for forming ~~an~~ the image using image recording signals, ~~said image according with a corresponding plurality of input image forming signals;~~

(b) memory means for storing data for said forming elements indicating the relative desirability of ~~utilising~~ utilizing said forming elements for forming the image; and

(c) image processing means for computing ~~said~~ biased image recording signals values using said ~~input image forming signals values~~ and said data stored in said memory means, wherein the use of a particular forming element is ~~thereby~~ biased dependent upon the relative desirability data of other forming elements, ~~the corresponding input image forming signal for the particular forming element, and a term for the particular forming element~~ and the image values for the other forming elements; and

halftoning means for halftoning the biased image values to form corresponding said image recording signals.

16. (Currently Amended) An image recording apparatus for recording an image comprising a plurality of image values, the apparatus comprising:

(a) a plurality of forming elements for forming ~~an~~ the image ~~according to input using image forming recording signals;~~

(b) memory means for storing data for said forming elements indicating the relative desirability of ~~utilising~~ utilizing said forming elements for forming an image;

(c) ~~image signal modification processing~~ means for redistributing said image values of said input image forming signal based on said data stored in said memory means so as to ~~bias~~ form redistributed image values the use of which biases use of said forming elements; and

halftoning means for halftoning the redistributed image values to form corresponding said image recording signals.

17. (Currently Amended) An image recording apparatus for recording an image comprising a plurality of image values, the apparatus comprising:

(a) a plurality of forming elements for forming ~~an~~ the image according to input using image forming recording signals;

(b) memory means for storing data for said forming elements indicating the relative desirability of ~~utilising~~ utilizing said forming elements for forming ~~an~~ the image;

(c) ~~image signal modification processing~~ means for redistributing said image values of said input image forming signals based on said data stored in said memory means ~~so as to bias~~ form redistributed image values the use of which biases the use of said forming elements, wherein the use of a particular one of said forming elements is thereby biased dependent upon the relative desirability data of other forming elements, ~~a corresponding input image forming signal for the particular forming element, and a term for the particular forming element and the image values for the other forming elements;~~ and

halftoning means for halftoning the redistributed image values to form corresponding said image recording signals.

18. (Currently Amended) ~~An~~ The image recording apparatus according to claim 16, ~~wherein~~ where: said image ~~signal modification~~ processing means for redistributing ~~values of said input image forming signals~~ values does not extend the range of said redistributed image values.

19. (Currently Amended) ~~An~~ The image recording apparatus according to claim 14, ~~wherein~~ where: said apparatus is a ~~colour~~ color image recording apparatus, said plurality of forming elements including plural groups of forming elements respectively corresponding to ~~colour~~ color components.

20. (Currently Amended) ~~An~~ The image recording apparatus according to claim 19, ~~wherein~~ where: said image processing means includes means for modifying the ~~input image forming signals~~ values relating to a ~~colour~~ color component based on said ~~input image forming signals~~ values and based on said data indicating the relative desirability of ~~utilising~~ utilizing said forming elements relating to other ~~colour~~ color components.

21. (Currently Amended) ~~An~~ The image recording apparatus according to claim 16, ~~wherein~~ where: said apparatus is a ~~colour~~ color image recording apparatus, said

plurality of forming elements including plural groups of forming elements respectively corresponding to ~~colour~~ color components.

22. (Currently Amended) ~~An~~ The image recording apparatus according to claim 21 further comprising:

image processing means for modifying said redistributed ~~input~~ image ~~forming signals~~ values relating to a ~~colour~~ color component based on said redistributed ~~input~~ image ~~forming signals~~ values and based on said data indicating the relative desirability of ~~utilising~~ utilizing said forming elements relating to other ~~colour~~ color components.

23. (Currently Amended) ~~An~~ The image recording apparatus according to claim 16, wherein ~~where:~~ said forming elements are capable of recording a “~~super~~” super density being greater than any density recorded by said forming elements when no image ~~forming signal~~ values are redistributed by said image ~~signal modification~~ processing means; and

wherein said image ~~signal modification~~ processing means is capable of biasing the use of said forming elements to record said super density.

24. (Currently Amended) ~~An~~ The image recording apparatus according to claim 23, wherein ~~where:~~ redistribution of ~~values of~~ said ~~input~~ image ~~forming signals~~ values is capable of extending the range of said values.

25. (Currently Amended) ~~An~~ The image recording apparatus according to claim 24 further comprising:

image processing means for re-mapping said redistributed image ~~forming signals~~ values so that the range of said values is restored to the range existing prior to said redistribution.

26. (Currently Amended) ~~An~~ The image recording apparatus according to claim 24, ~~wherein where:~~ said image processing means map redistributed image ~~forming signals~~ values to the range existing prior to said redistribution by maintaining distinct local average image values for image regions with differing constant ~~input image signal value~~ values.

27. (Currently Amended) ~~An~~ The image recording apparatus according to claim 26, ~~wherein where:~~ said image processing means map redistributed image ~~forming signals~~ values to the range existing prior to said redistribution by substantially dividing redistributed image values by 2 and alternately rounding up and rounding down.

28. (Currently Amended) ~~An~~ The image recording apparatus according to any one of claims 24 to 27, ~~wherein the further comprising:~~ halftoning means ~~which~~ generate image recording ~~element~~ signals ~~so that in which~~ the frequency of occurrence of super density recording by ~~recording~~ forming elements is adjusted according to halftoning parameters.

29. (Currently Amended) ~~An~~ The image recording apparatus according to claim 28, ~~wherein where:~~ said halftoning means generate image recording ~~element~~ signals by error diffusion processing such that the frequency of occurrence of super density recording by ~~recording~~ forming elements is adjusted according to values in an error diffusion table.

30. (Currently Amended) ~~An~~ The image recording apparatus according to ~~claims 14 to 29~~ claim 16 further comprising:

image ~~signal~~ value forcing means whereby image ~~signals~~ values corresponding to selected forming elements are set to prevent ~~recording;~~ recording, said selected forming elements being determined by said data indicating the relative desirability of ~~utilising~~ utilizing forming elements.

31. (Currently Amended) ~~An~~ The image recording apparatus according to ~~claims~~ claim 16 ~~to 30~~ further comprising:

(a) memory means storing data for said forming elements based on non-uniformity of the density of a recorded test image; and

(b) correction means for correcting said redistributed ~~input~~ image ~~forming signals~~ values based on said data stored in said memory means.

32. (Currently Amended) ~~An~~ The image recording apparatus according to ~~claims 14 to 31~~ wherein: claim 16, wherein each of said forming elements is a forming

element for ejecting a liquid drop by film-boiling due to ~~head~~ heat energy.

33. (New) A method according to claim 1, wherein the printing step is performed by one of a fixed head print system or a shuttle head print system operating in a single pass mode, wherein a line of dots of a color component is printed by a single nozzle.